EXPLANATION OF SIGNIFICANT DIFFERENCE FOR THE 100-HR-3 OPERABLE UNIT RECORD OF DECISION APRIL 2003

SITE NAME AND LOCATION

USDOE Hanford 100 Area
100-HR-3 Operable Unit
Hanford Site
Benton County, Washington

INTRODUCTION TO THE SITE AND STATEMENT OF PURPOSE

The Washington State Department of Ecology (Ecology), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy (DOE) are jointly issuing this Explanation of Significant Difference (ESD) to provide notice of revisions to the project schedule and cost estimate associated with the In Situ Redox Manipulation (ISRM) groundwater remedial action at the Hanford Site's 100-HR-3 Operable Unit (Figure 1). The original schedule and cost estimate for the remedial action was defined in the October 1999 amendment to the April 1996 Interim Remedial Action Record of Decision (ROD) for the 100-HR-3 Operable Unit. This ESD identifies revisions to the cost estimates associated with ISRM and explains that the addition of an evaporation pond also invokes an additional Applicable or Relevant or Appropriate Requirement (ARAR).

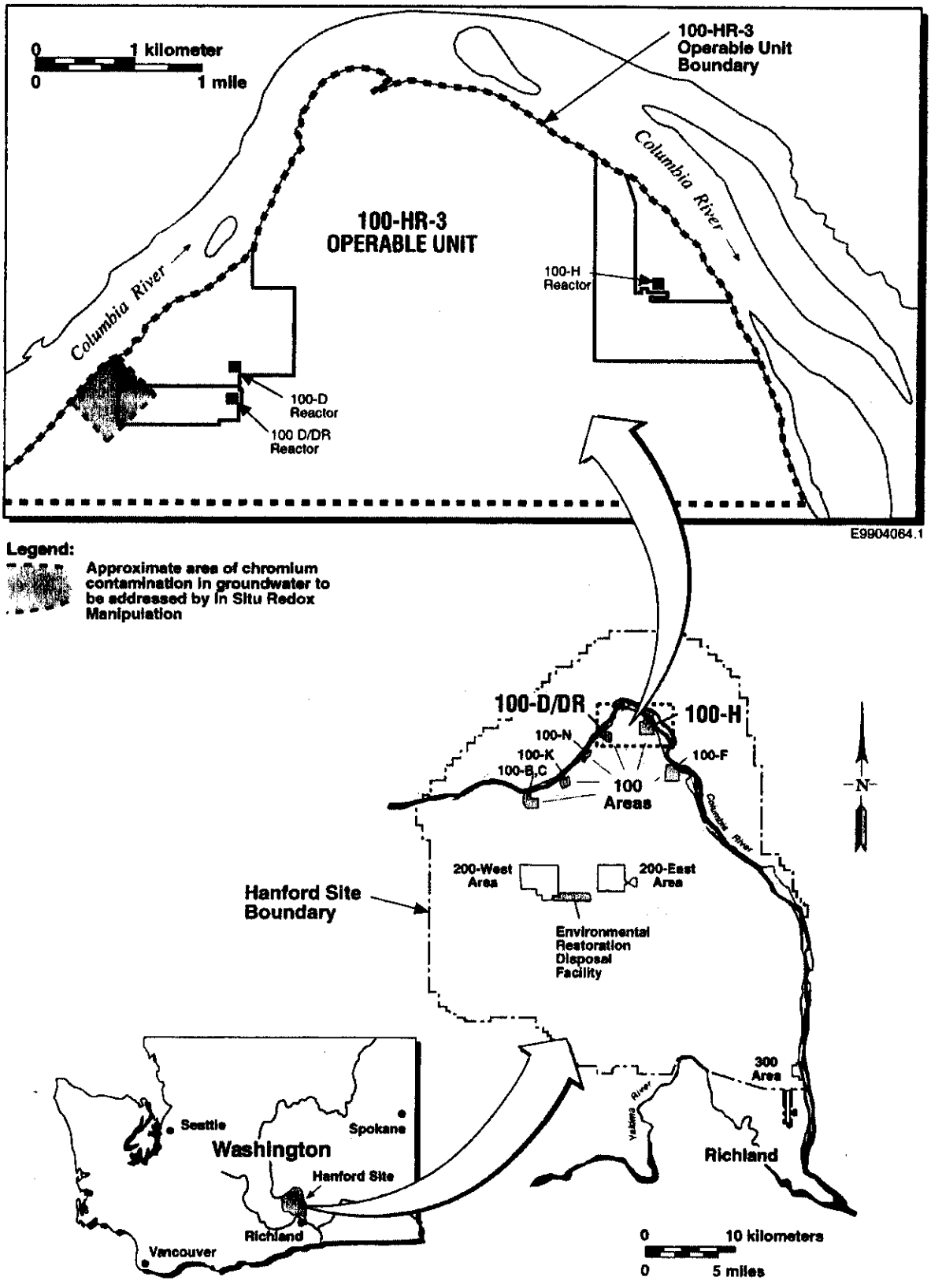
The EPA, Ecology, and DOE are issuing this ESD in accordance with Section 117(c) of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) and Section 300.435(c)(2)(i) of the CERCLA National Contingency Plan. This ESD will become part of the Administrative Record for the cleanup decision for the Hanford Site. The Administrative Record is available for review at the following location:

Administrative Record
2440 Stevens Center Place, Room 1101
Richland, Washington 99352
509/376-2530
Attention: Debbi Isom

SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

The 100-HR-3 Operable Unit is located in the north-central part of the Hanford Site along the Columbia River. This operable unit includes the groundwater underlying the 100-D/DR and 100-H Areas and the area between 100-D/DR and 100-H (Figure 1). The 100-D/DR Area is the site of two deactivated reactors: the 100-D Reactor, which operated from 1944 to 1967, and the 100-DR Reactor, which operated from 1950 to 1965. The 100-H Reactor operated from 1949 to 1965.

Figure 1. Location of the 100-HR-3 Operable Unit.



During operation, large volumes of treated Columbia River water were used as a coolant for these single-pass reactors. Sodium dichromate was added to the cooling water to inhibit corrosion of the piping. After passing through the reactor, the cooling water flowed through large-diameter underground piping to retention basins where it was held for a short period for thermal and radioactive cooling. From the retention basins, the cooling water was normally discharged into the main channel of the Columbia River via outfall pipes. During this process, both concentrated sodium dichromate and cooling water leaked to the soil, contaminating groundwater. Groundwater contaminated with chromium is present beneath the 100-D and 100-H Areas and is migrating toward, and discharging into, the Columbia River. The groundwater upwells into the river through the riverbed with minor contributions from riverbank seepage. The 1996 ROD selected the technology of pump-and-treat to intercept the hexavalent chromium plume under the 100-H and 100-D Areas and treat it using an ion-exchange treatment technology. Treated effluent is then returned to the aquifer using injection wells located upgradient of the existing 100-H Area chromium plume.

Between 1995 and 1997, high concentrations of hexavalent chromium were identified west of the 100-D/DR Reactor Area in groundwater well samples (Figure 1), local Columbia River pore water samples, and in near-river aquifer sampling tube groundwater samples. The DOE and Ecology, as the lead regulatory agency, determined a different remedial action than that selected in the 1996 ROD was appropriate for this plume. Therefore, an amendment to the remedial action was required. The 1999 ROD Amendment selected ISRM for remediation of this hexavalent chromium "hot spot" in the groundwater.

The 100-D Area ISRM process involves injecting chemicals into the aquifer through a series of wells parallel to the Columbia River shoreline to create a permeable treatment zone that the contaminated groundwater can flow through. The main chemical (sodium dithionite) reacts fairly rapidly with the naturally occurring iron in the soil creating a treatment zone that results in the conversion of hexavalent chromium into a less toxic and less mobile form of chromium (trivalent chromium). The majority of the remaining chemical reaction by-products (predominately sulfate) are then pumped out of the treated portion of the aquifer and transferred to the ISRM Evaporation Pond. Groundwater contaminated with hexavalent chromium passing through the treatment zone is reduced to the less toxic and less mobile trivalent chromium.

BASIS FOR THE DOCUMENT

The ROD Amendment (October 1999) specifies that the installation of the treatment barrier shall be fully implemented by the end of fiscal year 2002, based on current knowledge of the plume and implementability of the treatment technology. Milestone completion dates (Phase I, II and III, which correspond to the emplacement of sections of the barrier) were added to the Hanford Federal Facility Agreement and Consent Order (HFFACO) to ensure implementation by that date. The ISRM remedy requires additional time to implement based on a refinement of the design identified in the *Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) for the 100-HR-3 Groundwater Operable Unit In Situ Redox Manipulation* (ISRM) (DOE/RL-99-51, Rev. 1) and will be fully implemented by June 2003. The HFFACO Phase III Milestone was modified in accordance with the additional time requirement. Although the schedule has

changed, the implementation of this remedy remains consistent with the ROD Amendment remedial action objectives.

During the development of the ROD Amendment, several assumptions were used to develop a cost estimate based on data from small-scale treatability testing prior to obtaining characterization data. Design of the ISRM barrier was being conducted simultaneously with plume and aquifer characterization. Actual field conditions determined from the characterization data revealed a thicker than anticipated aquifer and a larger plume of chromium contamination. As a result, the cost estimate for the ISRM remedy presented in the ROD Amendment requires revision to reflect increases in costs associated with implementing the current refined treatment design and the changes in actual field conditions. By making these changes to the system's design, a maximized zone of capture for the hexavalent chromium-contaminated plume can be created.

DESCRIPTION OF SIGNIFICANT DIFFERENCES

The original cost and schedule was based on the construction of 40 wells and a barrier length of 610 m (2,000 ft), which gives an inferred well spacing of 15 m (50ft). The changes in the design that resulted in increased costs are: an increase in barrier length (from 610 m [2,000 ft] to 680 m [2,230 ft]), a decrease in well spacing of the system (from 15 m [50 ft] to 10.7 m [35 ft]), and the design and construction of a local evaporation pond for the disposal of extracted groundwater. The increase in barrier length and decrease in well spacing required the construction of 59 barrier wells. The existing wells used for the treatability testing and a monitoring well, were incorporated into the barrier. Changes in field conditions and technology emplacement resulted in increased drilling costs and chemical procurement costs that have occurred since issuance of the ROD Amendment. These cost increases were reflected in the RDR/RAWP.

The additional chemicals required due to the thicker aquifer and greater number of injection/extraction wells have created a significant increase in the volume of purgewater generated during operations. Another factor in the volume of purgewater generated was the need to remove the by-products of the injection process from the groundwater. Initial estimates were that only one purge volume would need to be removed, however actual field conditions drove that to a higher number and therefore a greater volume. The ROD Amendment cost estimate was based on releasing the majority of the purgewater to the ground through a drip field (i.e., a 500 foot long drip irrigation line constructed of perforated plastic piping), and therefore no cost estimate was included for waste management. However, due to the greater than anticipated volume of purgewater, and concerns with residual sulfate levels in groundwater from such a high volume, a method other than the drip field was required for managing the purgewater. Several alternatives were evaluated and construction of an evaporation pond was determined to be most cost effective. The use of an evaporation pond is less than the cost to transport water to a disposal facility, minimizes disposal of extracted groundwater to ground surface, and allows multiple simultaneous well injections and withdrawals.

The RDR/RAWP identified an additional action specific ARAR for the evaporation pond that was not included in the ROD Amendment. This ARAR, "Surface Impoundment Standards" (WAC 173-304-430) is applicable to the design, construction, and operation of the evaporation

pond that will be used to contain the water withdrawn from ISRM barrier emplacement well activities.

At the completion of the project, the evaporation pond and drip field will be dismantled. Any remaining purgewater will be trucked to the Purgewater Storage and Treatment Facility or the Effluent Treatment Facility for disposal. Any remaining sediments or precipitants will be collected as solid wastes and characterized to determine waste disposal requirements. The sulfate in the precipitate is not an environmental concern because sulfate is neither a carcinogen nor a toxic waste. The "Dangerous Waste Regulations" (WAC 173-303) are identified as an ARAR in the RDR/RAWP. Accordingly, the solid wastes, including the drip field, pond liner, and accumulated evaporation pond sediments, will be evaluated to determine whether they are a characteristic dangerous waste, and disposed as appropriate to the Environmental Restoration Disposal Facility (ERDF) or other approved Hanford Site landfill.

The Current Cost Projection provided in Table 1 of this ESD is based on actual project costs to date (Phase I and II) and an estimate of cost through the completion (Phase III) of the ISRM barrier. Table 1 compares the current cost projection to the cost presented in the ROD Amendment. The ROD Amendment was issued in October 1999 using the Proposed Plan capital estimate of approximately $3,920,000. The capital estimate for ISRM increased to approximately $8,729,000 to account for the changes noted previously. Capital costs associated with barrier construction are all engineering design costs (after conceptual design), facility construction costs, and other costs specifically related to those construction efforts, such as well drilling and construction, injection/extraction of sodium dithionate, and waste management including pond construction. Expense costs are those associated with the operation of the barrier. The annual operation and maintenance cost estimate has not changed. Table A-1 in Appendix A presents the total project cost. This appendix includes both capital and expense items. Phase II construction activities were completed within the projected cost estimate established at the completion of Phase I activities. Phase III activities are expected to be consistent with the revised cost estimate.

In summary, a revision to the ISRM construction schedule extends the project completion date from September 2002 to June 2003. Revisions to ISRM cost estimates increase the capital cost of the remedy by approximately $4.8 million as compared to the cost listed in the ROD Amendment. Current projected costs versus those presented in the ROD Amendment are shown in Table 1. The capital cost of ISRM construction is presently projected to be approximately $8.7 million. Cost increases and uncertainties include, but are not limited to, plume concentrations and migration anomalies, waste management, and changing aquifer conditions encountered during the construction phases.

Table 1. ISRM System Cost Comparison.[a]

	ISRM per ROD Amendment[a]	ISRM Current Cost Projection
Capital $[b]	$ 3,920,000	$ 8,729,000
Annual Operation and Maintenance [c]	$ 50,000	$ 50,000
Net Present Value [d] (5-year period)	$ 4,136,000	$ 8,952,900
Net Present Value [d] (10-year period)	$ 4,330,000	$ 9,138,600
Net Present Value [d] (20-year period)	$ 4,612,000	$ 9,420,800

[a] Cost estimate +50% to –30%.

[b] Capital costs include: engineering, well construction, injection/extraction, and waste management (pond construction). No estimate was made for waste management in the ROD Amendment estimate.

[c] Estimate yearly operations and maintenance of the installed ISRM reactive treatment zone. Assumes ISRM barrier performance evaluation is incorporated into the existing 100-HR-3 Operable Unit reporting and management structure.

[d] Based on discount rate of 3.8% and inflation rate of 2.7% for out years.

NON-LEAD REGULATORY AGENCY COMMENTS

The lead regulatory agency is the Washington State Department of Ecology, with EPA as the non-lead regulatory agency. By issuance of this ESD, EPA, DOE/RL and Ecology have agreed to extend the completion date and to revise the cost estimates as described in this ESD for the ISRM system, which is the selected remedy for the 100-D Area hexavalent chromium contaminated groundwater.

STATUTORY DETERMINATIONS

This modified remedy satisfies CERCLA Section 121. The ROD Amendment selected remedy, as modified by this ESD:

- is protective of human health and the environment,
- complies with Federal and State requirements that are ARARs to remedial actions, as identified in the ROD Amendment, as modified by this ESD,
- is cost-effective, and
- uses permanent solutions and alternative treatment technologies to the maximum extent practicable.

In addition, to the extent practicable for the waste sites plumes, the remedy employs treatment that reduces the volume, toxicity, or mobility of hazardous wastes as their principal element.

The response action selected by the ROD Amendment as modified in this ESD is necessary to protect the public health, welfare, or the environment from actual or threatened releases of

hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

PUBLIC PARTICIPATION COMPLIANCE

The public participation requirements set out in Section 300.435(c)(2)(i) of the National Contingency Plan are met through issuance of this ESD and advertisement in the local daily newspaper, the Tri-City Herald.

APPENDIX A: ISRM Total Construction Cost Estimate Projection

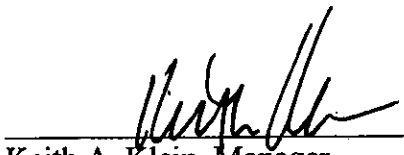
Table A-1 includes all project related expenses that were not included in Table 1 through the completion of the barrier, to provide a total cost for implementation of the ISRM project.

Table A-1. Detail of Current Cost Projection in Table 1.

	Item Estimated	Cost	Notes[a]
Capital Items	Engineering	$ 985,000	Costs include engineering for scaling up treatability study to full scale emplacement. This activity includes engineering for pond design, barrier design, engineering for well drilling, electric systems, utility enhancements, and support to cultural resources.
	Drilling	$ 2,773,000	Costs associated with constructing barrier and monitoring wells.
	Waste Management	$ 325,000	Handling of extracted water and drilling waste associated with constructing wells.
	Evaporation Pond	$ 424,000	Construction of pond.
	Barrier Emplacement	$4,222,000	Costs include chemicals and labor associated with the injection/extraction wells.
	ISRM Capital Construction Cost	**$ 8,729,000**	Estimated capital construction cost to install the ISRM passive treatment zone.
Expense Costs associated with completing ISRM construction through Phase III			
Expense Items	Barrier Emplacement Monitoring	$ 285,000	Sampling and analysis of barrier wells during injection and extraction.
	Performance Monitoring	$ 769,000	Sampling of monitoring wells and access tubes for off-site analysis and other (radionuclide constituents). Also includes evaluation and reporting of data.
	Water Level Monitoring	$ 59,000	Monitoring of water levels in D-Area to determine direction of plume movement.
	Project Specific Database	$ 132,000	Data loading and manipulation of project specific data.
	Pond Decommissioning	$ 686,000	Projected cost of decommissioning of pond when no longer needed.
	ISRM Expense Construction Cost	**$ 1,931,000**	
	Total Project ISRM Construction Cost	**$ 10,660,000**	

[a] The notes explain the cost components for the capital and expense items.

Signature sheet for the Record of Decision Amendment ESD for the U.S. Department of Energy Hanford 100-HR-3 Operable Unit interim remedial action between the U.S. Department of Energy and the Washington State Department of Ecology, with concurrence by the U.S. Environmental Protection Agency.



3/24/03

Keith A. Klein, Manager
Richland Operations Office
U.S. Department of Energy

Date

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Michael A. Wilson
Program Manager, Nuclear Waste Program
Washington State Department of Ecology

7/7/08
Date

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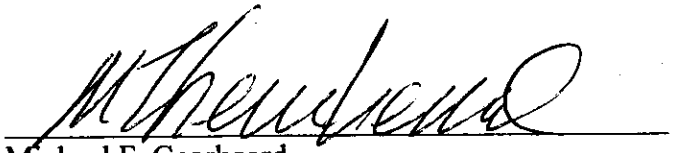

3/31/03

Michael F. Gearheard
Director Environmental Clean Up Office, Region 10
U.S. Environmental Protection Agency

Date